

Application No. 10/712,044
Amendment dated October 20, 2005
Reply to Office Action of July 20, 2005

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AMENDMENTS TO THE CLAIMS

1. (Original). A liquid oligomeric composition comprising:
a cycloaliphatic epoxide; and
an organic soluble, ungelled, uncrosslinked, Michael addition polyacrylate reaction product.
2. (Original). The liquid oligomeric composition, according to claim 1, wherein said Michael addition polyacrylate product is formed from a multifunctional acrylate Michael acceptor and a β -dicarbonyl Michael donor.
3. (Currently amended). The liquid oligomeric composition, according to claim [[1]] 2, wherein said β -dicarbonyl Michael donor is selected from the group consisting of β -keto esters, β -diketones, β -ketoamides, β -ketoanilides, and mixtures thereof.
4. (Currently amended). The liquid oligomeric composition, according to claim [[1]] 2, wherein said multifunctional acrylate Michael acceptor is selected from the group consisting of diacrylates, triacrylates, and tetraacrylates.
5. (Currently amended). The liquid oligomeric composition, according to claim [[1]] 2, wherein said β -dicarbonyl Michael donor is a β -diketone or a β -ketoester.
6. (Original). The liquid oligomeric composition, according to claim 3, wherein said β -dicarbonyl has equivalent functionality (N) wherein N = 2, 4, 6, or 8.

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7. (Original). The liquid oligomeric composition, according to claim 4, wherein the molar acrylic functional group ratio of said diacrylate Michael acceptor to said β -dicarbonyl donor is:

$\geq 1:1$ where said β -dicarbonyl functionality=2,
 $\geq 4.5:1$ where said β -dicarbonyl functionality=4,
 $\geq 4.5:1$ where said β -dicarbonyl functionality=6, and
 $\geq 3.5:1$ where said β -dicarbonyl functionality=8.

8. (Original). The liquid oligomeric composition, according to claim 4, wherein the molar acrylic functional group ratio of said triacrylate Michael acceptor to said β -dicarbonyl donor is:

≥ 2.25 where said β -dicarbonyl functionality=2,
 $\geq 6.4:1$ where said β -dicarbonyl functionality=4,
 $\geq 7.8:1$ where said β -dicarbonyl functionality=6, and
 $\geq 7.4:1$ where said β -dicarbonyl functionality=8.

9. (Original). The liquid oligomeric composition, according to claim 4, wherein the molar acrylic functional group ratio of said tetraacrylate Michael acceptor to said β -dicarbonyl donor is:

≥ 6.6 where said acetoacetate functionality=2,
 $\geq 12.3:1$ where said β -dicarbonyl functionality=4,
 $\geq 13.2:1$ where said β -dicarbonyl functionality=6, and
 $\geq 12.7:1$ where said β -dicarbonyl functionality=8.

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10. (Original). The liquid oligomeric composition, according to claim 1, wherein said cycloaliphatic epoxide has a Brookfield viscosity of <1,000 cP at 25°C.

11. (Original). The liquid oligomeric composition, according to claim 10, wherein said cycloaliphatic epoxide is selected from the group consisting of 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate and bis-(3,4-epoxycyclohexyl) adipate.

12-13. (Canceled).

14. (Original). The liquid oligomeric composition, according to claim 11, wherein a preferred cycloaliphatic epoxide is 3,4-epoxycyclohexylmethyl-3,4-epoxycyclohexane carboxylate.

15. (Original). The liquid oligomeric composition, according to claim 1, wherein said Michael addition reaction is carried out in the presence of a strong base.

16. (Currently amended). The liquid oligomeric composition, according to claim ~~[[13]]~~ 15, wherein said base is chosen from the group consisting of cyclic amidines, guanidines, group I alkoxides, quaternary hydroxides, quaternary alkoxides, and alkoxide bases generated *in situ* by reaction between a halide anion and an epoxy moiety.

17. (Currently amended). The liquid oligomeric composition, according to claim ~~[[14]]~~ 15, wherein said base is ~~chosen~~ selected from the group consisting of diazabicycloundecene (DBU), diazabicyclo-nonene (DBN), and 1,1,3,3-tetramethyl guanidine.

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18. (Currently amended). The liquid oligomeric composition, according to claim ~~[[14]]~~ 15, wherein said base is an alkoxide ~~[[is]]~~ generated in-situ by reaction between a quaternary halide and an epoxide moiety.

19. (Original). The liquid oligomeric composition, according to claim 4, wherein said diacrylate is selected from the group consisting of:

ethylene glycol diacrylate, propylene glycol diacrylate,
diethylene glycol diacrylate, dipropylene glycol diacrylate,
triethylene glycol diacrylate, tripropylene glycol diacrylate,
tetraethylene glycol diacrylate, tetrapropylene glycol diacrylate,
polyethylene glycol diacrylate, polypropylene glycol diacrylate,
ethoxylated bisphenol A diacrylate,
bisphenol A diglycidyl ether diacrylate,
resorcinol diglycidyl ether diacrylate,
1, 3-propanediol diacrylate,
1, 4-butanediol diacrylate,
1, 5-pentanediol diacrylate,
1, 6-hexanediol diacrylate,
neopentyl glycol diacrylate,
cyclohexane dimethanol diacrylate,
ethoxylated neopentyl glycol diacrylate, propoxylated neopentyl glycol
diacrylate, ethoxylated cyclohexanedimethanol diacrylate, propoxylated
cyclohexanedimethanol diacrylate,
acrylated epoxy diacrylates,
aryl urethane diacrylates, aliphatic urethane diacrylates, polyester
diacrylates, and mixtures thereof.

20. (Original). The liquid oligomeric composition, according to claim 4, wherein said triacrylate is selected from the group consisting of:

trimethylol propane triacrylate,
glycerol triacrylate,
ethoxylated trimethylolpropane triacrylate, propoxylated trimethylolpropane triacrylate, tris
(2-hydroxyethyl) isocyanurate triacrylate,
ethoxylated glycerol triacrylate, propoxylated glycerol triacrylate,

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pentaerythritol triacrylate,
aryl urethane triacrylates, aliphatic urethane triacrylates,
melamine triacrylates,
aliphatic epoxy triacrylates,
epoxy novolac triacrylates,
polyester triacrylates and mixtures thereof.

21. (Original). The liquid oligomeric composition, according to claim 4, wherein said tetraacrylate is selected from the group consisting of

di-trimethylolpropane tetraacrylate
pentaerythritol tetraacrylate,
ethoxylated pentaerythritol tetraacrylate, propoxylated pentaerythritol
tetraacrylate, dipentaerythritol tetraacrylate,
ethoxylated dipentaerythritol tetraacrylate, propoxylated dipentaerythritol
tetraacrylate,
aryl urethane tetraacrylates, aliphatic urethane tetraacrylates, polyester
tetraacrylates,
melamine tetraacrylates,
epoxy novolac tetraacrylates, and mixtures thereof.

22. (Original). The liquid oligomeric composition, according to claim 6, wherein said β -dicarbonyl donor compound having functionality = 2 is selected from the group consisting of:

ethyl acetoacetate,
methyl acetoacetate,
2-ethylhexyl acetoacetate,
lauryl acetoacetate,
t-butyl acetoacetate,
acetoacetanilide,
N-alkyl acetoacetanilide
acetoacetamide,
2-acetoacetoxylethyl methacrylate,
allyl acetoacetate,

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benzyl acetoacetate,
2, 4-pentanedione,
isobutyl acetoacetate, and
2-methoxyethyl acetoacetate.

23. (Original). The liquid oligomeric composition, according to claim 6, wherein said β -dicarbonyl donor compound having functionality = 4 is selected from the group consisting of:

1,4-butanediol diacetoacetate,
1,6-hexanediol diacetoacetate,
neopentyl glycol diacetoacetate,
cyclohexane dimethanol diacetoacetate, and
alkoxylated bisphenol A diacetoacetate.

24. (Original). The liquid oligomeric composition, according to claim 6, wherein said β -dicarbonyl donor compound having functionality = 6 is selected from the group consisting of:

trimethylol propane triacetoacetate,
glycerin triacetoacetate, and
polycaprolactone triacetoacetates and alkoxylated derivatives thereof.

25. (Original). The liquid oligomeric composition, according to claim 6, wherein said β -dicarbonyl donor compound having functionality = 8 is pentaerythritol tetraacetoacetate and alkoxylated derivatives thereof.

26. (Original). The liquid oligomeric composition, according to claim 2, wherein said Michael addition reaction occurs in the presence of at least one non-reactive solvent.

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27. (Original). The liquid oligomeric composition, according to claim 24, wherein said non-reactive solvent is selected from the group consisting of styrene, t-butyl styrene, α -methyl styrene, vinyl toluene, vinyl acetate, allyl acetate, allyl methacrylate, diallyl phthalate, C_{1-18} -methacrylate esters, dimethacrylates, and trimethacrylates.

28. (Original). The liquid oligomeric composition, according to claim 1, wherein said composition is shelf stable for more than one month and has residual pendant unsaturated acrylate groups.

29 - 42. (Canceled).

43. (Original). The liquid oligomeric composition, according to claim 2, wherein said composition further comprises at least one additive.

44. (Original). The liquid oligomeric composition, according to claim 43, wherein said additive is selected from the group consisting of pigments, gloss modifiers, flow and leveling agents and other additive as appropriate to formulate coatings, paints, laminates, sealants, adhesives and inks.

45 - 53. (Canceled).

54. (Previously presented). The liquid oligomeric composition, according to claim 2, further comprising a cationic photoinitiator.